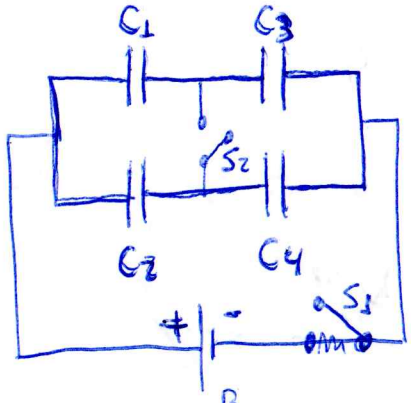
Cap. 25 Ex 27



12 V

$C_1 = 1{,}0\,\mu F$

$C_2 = 2{,}0\,\mu F$

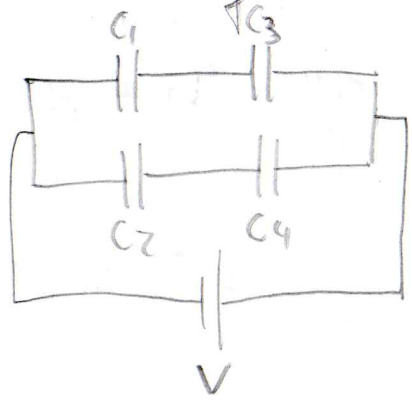
$C_3 = 3{,}0\,\mu F$

$C_4 = 4{,}0\,\mu F$

S_1 fechado q_1, q_2, q_3, q_4?

S_1 e S_2 fechado q_1, q_2, q_3, q_4?

Quando S_1 fechado



C_1 série com C_3, logo

$q_1 = q_3$

$q_1 = C_1 V_1$, $q_3 = C_3 V_3$

$V_1 + V_3 = V$

$$\frac{q_1}{C_1} + \frac{q_3}{C_3} = V$$

$$\frac{q_1}{C_1} + \frac{q_1}{C_3} = V$$

$$\frac{q_1(C_1 + C_3)}{C_1 C_3} = V$$

$$q_1 = \frac{C_1 C_3 V}{C_1 + C_3}$$

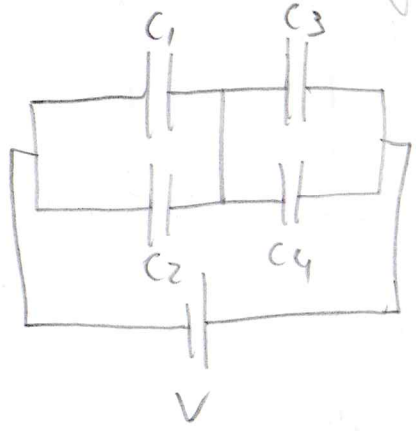
$$q_1 = \frac{(1\,\mu F)(3\,\mu F)(12\,V)}{(1\,\mu F) + (3\,\mu F)}$$

$q_1 = 9\,\mu V/F = 9\,\mu C = q_3$

analogamente p/ q_2 e q_4.

$$q_2 = \frac{C_2 C_4 V}{C_2 + C_4} = 16\,\mu C = q_4$$

Quando S_1 e S_2 fechados.



$C_1 // C_2$ e $C_3 // C_4$

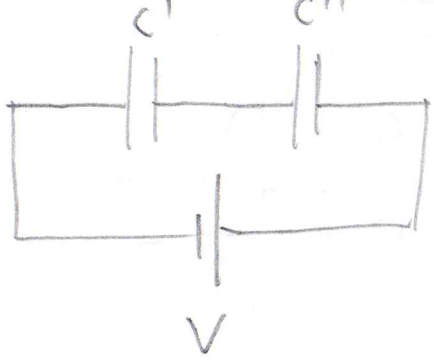
$q_1 = C_1 V'$ $\quad q_3 = C_3 V''$

$q_2 = C_2 V'$ $\quad q_4 = C_4 V''$

Portanto teremos uma capacitância equivalente entre C_1 e C_2 e C_3 e C_4

$C' = C_1 + C_2$ $\quad$ $C'' = C_3 + C_4$

O circuito pode ser reduzido a:



C' série c/ C''

$V' + V'' = V$

$$\frac{q'}{C'} + \frac{q''}{C''} = V$$

Onde $q' = q_1 + q_2$

$q'' = q_3 + q_4$

$$\frac{q_1 + q_2}{C'} + \frac{q_3 + q_4}{C''} = V$$

mas $\boxed{q' = q''}$, logo

$$\frac{q_1 + q_2}{C'} + \frac{q_1 + q_2}{C''} = V$$

$$\frac{C_1V' + C_2V'}{C_1 + C_2} + \frac{C_1V' + C_2V'}{C_3 + C_4} = V$$

$$V' + V'\frac{(C_1 + C_2)}{C_3 + C_4} = V$$

$$\frac{C_3V' + C_4V' + C_1V' + C_2V'}{C_3 + C_4} = V$$

$$V' = \frac{(C_3 + C_4)V}{C_1 + C_2 + C_3 + C_4}$$

$$V' = \frac{(3\mu F + 4\mu F)\,12\,V}{1\mu F + 2\mu F + 3\mu F + 4\mu F}$$

$V' = 8,4\,V$

$q_1 = C_1V' = 1\mu F \cdot 8,4\,V$

$q_1 = \underline{8,4\,\mu C}$

$q_2 = C_2V' = 2\mu F \cdot 8,4\,V$

$q_2 = \underline{16,8\,\mu C}$

$q_3 = C_3V'' = C_3(V - V')$

$q_3 = 3\mu F(12 - 8,4)$

$q_3 = 3\mu F \cdot 3,6\,V = \underline{10,8\mu C}$

$q_4 = 4\mu F \cdot 3,6\,V = \underline{14,4\mu C}$